



Published in final edited form as:

J Public Health Dent. 2015 September ; 75(4): 327–336. doi:10.1111/jphd.12104.

Perceived safety and benefit of community water fluoridation: 2009 HealthStyles survey

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Abstract

Objectives—To describe perceived benefits and safety of community water fluoridation (CWF) and investigate factors associated with those perceptions of CWF among respondents to a proprietary survey in the United States.

Methods—We obtained data from the 2009 HealthStyles survey, a convenience sample of 4,556 respondents. Pearson's chi-squared and logistic regression were used to determine the associations between certain socio-demographic factors and perceptions regarding the safety and health benefits of CWF.

Results—The majority of respondents (55.3 percent) strongly agreed/agreed that CWF was safe, while 31.5 percent were neutral, and 13.2 percent disagreed/strongly disagreed. Twenty-seven percent of respondents reported CWF had no health benefit, 57.3 percent reported some benefit, and 15.5 percent reported great benefit. Perceived CWF safety and benefit in the bivariate analyses were associated with gender, age, race/ethnicity, education, marital status, income, sealant knowledge, CWF knowledge, past year dental utilization, and perceived vaccine safety. Respondents with knowledge of CWF (47.9 percent) were more likely to agree that it was safe (69.8 percent) than those who reported no knowledge (41.3 percent). Among respondents who said childhood vaccines were not safe (4.0 percent), almost half disagreed that CWF was safe. Logistic regression results indicated that perceived CWF safety and benefits increased with CWF knowledge, perceived vaccine safety, and income.

Conclusions—Although only a minority of the US population perceived CWF as unsafe or providing no benefit to health, perceptions regarding CWF varied by knowledge of CWF and socio-demographic factors. Oral health promotion activities should consider these differing perceptions of CWF among groups to tailor oral health messaging appropriately.

Keywords

community water fluoridation; fluoride; dental public health; effectiveness; safety

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The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Introduction

Systematic reviews have documented the effectiveness and cost-effectiveness of community water fluoridation (CWF) in preventing dental caries (1-4). Reviews have also supported the safety of water fluoridation with unwanted effects limited to dental fluorosis (1-4). Despite such evidence, public opinion polls have indicated that approximately 10-20 percent of the US population opposes CWF (5). Opinions can vary by region and appear to be influenced by the presence of groups supporting or opposing implementation of CWF (5,6).

Objections to implementing CWF include concerns about its current effectiveness when other fluoride modalities, such as toothpaste and topical fluoride agents, are widely available (7). Opponents may also worry about reported increases in the prevalence of dental fluorosis that suggest children may be taking in too much fluoride which they also think could place them at risk for other potential adverse health effects (7-9). Such statements exemplify the difficulty communities encounter in making a complex public health decision when their knowledge is limited and they perceive risk to be greater than the science indicates (10). Armfield and Akers (11) described CWF as a “low-risk, high-outrage controversy,” and found that fears of long-term unknown adverse effects were of greatest concern.

In the United States, social science research focusing on knowledge and perceptions of CWF occurred primarily between the 1950s and 1970s (5,12). A 1980 review (12) compared local, state, and national survey findings that addressed, for example: a) public awareness [i.e., heard or read about CWF (range: 56-82 percent)]; b) public knowledge [i.e., correct identification of CWF's purpose (range: 44-76 percent)]; and c) desire to implement CWF (range: 51-77 percent of those aware of CWF). Because of the differences among survey methods, direct comparisons over time were not possible. Subsequent US surveys have focused primarily on knowledge of CWF (13,14). An analysis using a mail panel survey (13) found that in both 2003 and 2009, 48 percent of respondents knew the purpose of CWF, a value lower than the 62 percent reported in an analysis of data from the 1990 National Health Interview Survey (14). In 2003 and 2009, knowledge of CWF was lower among younger adults (<45 years), nonwhites, those with lower incomes and education, and those without a dental visit during the past year (13).

Recent studies that examined opinions about CWF have been conducted in Canada (15), Australia (9,16), New Zealand (17), Europe (18), and Japan (19). Quinonez and Locker (15) reported that approximately half of Canadian respondents were aware (i.e., heard or read) of CWF, and of those who were aware, about 60 percent thought it both safe and effective; 23 percent reported that it was not beneficial, and 21 percent did not believe it safe. Support for CWF was associated with higher incomes and more frequent visits to dentists, while those less likely to support CWF had children were covered by public dental insurance or avoided fluoride products. Armfield and Akers (9) reported that 70.1 percent of Australian respondents supported CWF, 14.5 percent were neutral, and 15.4 percent opposed it. Respondents reporting higher levels of self-rated CWF knowledge were more likely to strongly support (64.1 percent) or strongly oppose (30.8 percent) CWF compared with those with no knowledge (82.4 percent neutral). A focus group study (18) of opinions about CWF in 16 European countries reported, “many [participants] felt dental health was an issue to be

dealt with at the level of the individual, rather than a solution to be imposed en masse.” In Japan, where CWF has not existed since 1972, Furukawa *et al.* (19) found that survey respondents who had more experience with fluoride (e.g., through fluoride toothpaste use or children who received a fluoride treatment at a dental visit) reported lower anxiety and were more likely to support CWF.

Although these studies suggest that respondents generally support CWF, only about 50 percent of respondents know its purpose, and opinions regarding the need for this public health intervention vary. This could deter communities from implementing this potentially beneficial intervention. In 2009, the HealthStyles survey (20) included questions on knowledge and perceived safety and benefits of CWF. In this study, we use these data to identify factors associated with public perceptions of CWF's safety and benefits. This information can help in developing and implementing strategies to promote initiation and continuation of CWF.

Methods

Dataset

For this study, we used data from the Porter-Novelli 2009 HealthStyles Survey – a proprietary survey that assesses knowledge, practices, attitudes, and beliefs related to health among adults aged 18+ years (20). The HealthStyles sample was obtained from a marketing convenience sample (20). The convenience sample consisted of 328,000 respondents to previous surveys sent out over the years by Synovate, Inc., a market research firm. In the first stage of sampling, 21,420 persons were drawn for the ConsumerStyles survey (Figure 1). Although ConsumerStyles was obtained from a convenience sample, the sample was stratified on region, household income, population density, age, and household size to create a sample distribution similar to the national distribution. Low-income and minority groups were oversampled to have sufficient representation of these groups. In the second stage, 7,004 persons were drawn for the HealthStyles survey from the 10,587 persons who completed and returned the ConsumerStyles survey. HealthStyles surveys were returned by 4,556 persons. Over 97 percent of these persons answered the questions regarding CWF safety and benefit. Figure 1 describes how our final sample of 4,556 persons was obtained. Survey respondents were assigned simple weights based on sex, age, income, race, and household size so that prevalence estimates would be representative of the US Census population (20). The sum of the weights equaled the sample size of 4,556.

Variables measuring CWF perceptions

Two questions in HealthStyles served as the basis for dependent variables described in the analysis section:

- CWF Safety

Do you personally agree or disagree with the statement, “It is safe to drink water from community water systems that add fluoride.” Respondents answered using a 5-point Likert scale, labeled as “strongly disagree” (1), “somewhat disagree” (2), “neither agree nor disagree” (3), “somewhat agree” (4), and “strongly agree” (5).

- CWF Benefits

“How much benefit do you believe is likely to occur to a person's health if they routinely drink water that contains fluo-ride?” Respondents answered using a 10-point Likert scale, labeled as “no benefit” (1) to “great benefit” (10).

Consistent with the approaches used in previous analyses of HealthStyles questions regarding perceived safety of water and vaccines (21,22), we combined CWF safety responses 1 and 2 into “not safe,” treated 3 as “neutral,” and combined 4 and 5 into “safe.” For CWF benefit, we combined responses 1-3 into “no benefit,” 4-7 into “some benefit,” and 8-10 into “great benefit.”

Independent variables

We included socio-demographic and behavioral variables previously found to be associated with dental knowledge (13) and perceptions toward CWF (15). Independent variables included sex; age; race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, other); education [not high school (HS) graduate, HS graduate, attended college, college graduate]; marital status (married/domestic partner, widowed/divorced/separated, never married); having children 18 years living at home; household income; region (New England, Midwest, South, and West); knowledge of dental sealants; knowledge of the reason fluoride is added to community water systems (i.e., knowledge of CWF); and whether the respondent had visited a dentist within the past year. Perceived safety of childhood vaccines also was included to assess perceptions toward public health interventions. Respondents answered the question “In general, how safe do you think vaccines are for children?” using a 10-point Likert scale that ranged from “not at all safe” (1) to “very safe.” As described by Kennedy *et al.* (21), we classified responses of 1-3 as “not safe,” 4-7 as “neutral,” and 8-10 as “safe.”

Analysis

We used a chi-squared test to examine if perceptions of CWF safety and benefit varied by each of the independent variables. For the multivariate analyses of factors associated with perceptions toward CWF safety, we used two separate logistic regressions – the dependent variable in one was “safe or neutral” versus “not safe” and in the second was “safe” versus “neutral or not safe.” Similarly, we ran two logistic regressions for perceptions regarding CWF health benefit with the dependent variable of “great or some” versus “none” in the first and “great” versus “some or none” in the second. A Wald test was used to test whether the obtained odds ratios were significant. We used sas for Windows version 9.3 (SAS Institute, Inc. Cary, NC, USA) for all analyses. All findings reported in the text were determined to be significant at the 5 percent level. We used a Hosmer–Lemeshow test to assess the fit of the logistic regression model. Because of the potential problems of using sample weights in regressions (23) and because the Hosmer–Lemeshow tests indicated a poor model fit ($P < 0.05$) for all regressions using weighted data, inferential analyses were conducted without the sample weights. The analysis was exempt from the CDC Institutional Review Board because personal identifiers were not included in the data provided to CDC.

Results

Socio-demographic characteristics of the weighted and nonweighted study sample are provided in Table 1. About half the sample knew the purpose of dental sealants or CWF; almost 4 percent thought vaccines were not safe (Table 1).

A majority of respondents (55 percent) strongly agreed/agreed that CWF was safe, while about 31 percent were neutral, and 13 percent disagreed/strongly disagreed (Table 2). The majority of respondents (about 57 percent) perceived CWF as providing some health benefit, while about 15 percent perceived the benefit as great and about 27 percent no benefit (Table 2).

Bivariate associations

Both perceived CWF safety and CWF benefit were associated with all independent variables except having children 18 years living at home and region of the country where resided (Table 3). Agreement with safety of CWF was highest among respondents with knowledge of CWF (68.9 percent), college graduates (67.9 percent), and with the highest incomes (67.5 percent), while the highest disagreement with CWF safety (44.7 percent) was among respondents who perceived childhood vaccines as not at all safe. Groups most likely to perceive CWF as providing a great benefit were those with household incomes \$100,000 (20.1 percent), college degrees (20.3 percent), knowledge of CWF (19.1 percent), and those responding that vaccines were very safe (19.0 percent), while groups most likely to perceive CWF as providing no benefit included respondents who perceived childhood vaccines as not safe (65.5 percent) and those with household incomes \$24,999 (36.4 percent).

Multivariate associations

In all logistic regressions, both perceived CWF safety and benefit increased as knowledge of CWF and perceived vaccine safety increased (Table 4). Perceived benefits and safety were also higher for persons with incomes exceeding \$24,999. In at least one of the logistic regressions, perceived CWF safety was higher among males, non-Hispanic white persons, and persons 65+ years compared with females, Hispanics or other race/ethnicity groups, and persons 18-29 years old. College graduates, respondents who knew the purpose of dental seal-ants, or those with a past year dental visit also had higher odds of perceiving CWF as safe compared with persons who had not graduated from HS, those who did not know the purpose of dental sealants, and those without a past-year dental visit. Also, the odds of responding CWF provided a benefit were higher among Hispanics and never-married persons compared with non-Hispanic whites and married persons or widowers.

In the logistic regressions for perceived CWF safety, combining neutral with “not safe” responses resulted in more independent variables being statistically significant ($n = 12$ subcategories, $n = 8$ independent variables) compared with combining CWF neutral with “safe” ($n = 11$ subcategories, $n = 6$ independent variables). The Hosmer–Lemeshow test also indicated that combining neutral with not safe provided a better model fit to the data than did combining neutral with safe (P value of 0.92 versus 0.19). The P values, however, for the logistic regressions that combined some benefit with no benefit and the logistic regression

that combined some benefit with great benefit were fairly similar (0.61 and 0.55). While the latter regression (some or no benefit) had more significant independent variables (5 versus 3), it had fewer significant subcategories (6 versus 7).

Discussion

This study found that although nearly three-fourths of respondents perceived CWF as providing some or great benefit, only about half could identify its correct purpose, a proportion at the low end of the range found (44-76 percent) during the 1950s to 1970s (12). We believe this is the first study of perceptions of CWF that included CWF knowledge and perceived safety of childhood vaccines in a multivariate analysis. Our finding of a strong association between CWF knowledge and perceived safety and benefit is especially important, given that approximately half of the 2009 HealthStyles respondents were unable to correctly identify the purpose of CWF (13). These incorrect responses could stem from persons having the wrong information about the purpose of CWF or from their not being familiar with CWF. If the latter, lack of familiarity could contribute to negative perceptions about CWF. Studies on ambiguity aversion (24,25) suggest that persons prefer known to unknown risks. Thus, among persons unfamiliar with CWF, educational campaigns might be effective in altering perceptions about CWF safety and benefit. Changing the information set of persons who are misinformed about the purpose of CWF, however, may be more difficult, for example, a previous study (9) found that persons opposed to CWF rate their knowledge about CWF as considerable or moderate. Our finding that perceptions about CWF safety are strongly associated with perceptions about vaccine safety also suggests that the success of CWF information campaigns sponsored by governmental agencies may depend on whether persons trust the government as a source for health information (26).

Conceptually, there are similarities between CWF and vaccines (27). Both involve trust in governmental recommendations, belief in the adequacy of research to support safety and benefits of the practice, and a focus on primary prevention of disease. Our bivariate analysis demonstrated that, of respondents who viewed childhood vaccines not at all safe, almost half viewed CWF as not safe. It is important to note that only 4.0 percent of survey respondents said that childhood vaccines are "not at all safe," compared with 13.2 percent of respondents who strongly disagreed/ disagreed with the safety of CWF, a difference that could result from the public's being more familiar with vaccines (28). Limiting the current study to respondents with CWF knowledge, 8.29 percent disagreed that CWF was safe, a difference suggesting that CWF could be perceived as less safe than childhood vaccines. Still, caution should be exercised with all interpretations because different Likert scales were used for these questions in the HealthStyles survey.

We also believe that this is the first multivariate analysis to examine associations of race/ethnicity with CWF perceptions. In this study, Hispanics were more likely to perceive CWF as providing great benefit versus some or no benefit compared with non-Hispanic whites. In a bivariate analysis of New Zealand survey data, Campbell *et al.* (17) noted the differences among ethnic groups in their knowledge of CWF, perceived health benefits, and perceived health hazards. Persons of European ethnicity were most likely to have CWF knowledge and

to perceive CWF as beneficial to health. Our current study demonstrated that after controlling for CWF knowledge, differences in perceptions by ethnicity still existed.

Differences in perceptions between racial and ethnic groups about the safety of water are not limited to the adjustment of water fluoride content. Nonwhites reportedly are less likely to agree that tap water is safe than are whites (22,29). Perceiving tap water as unsafe may result in lower consumption of it and increased use of potentially nonfluoridated bottled water or sugar-sweetened beverages (22). These findings are especially worrisome because non-whites typically have higher prevalence of untreated dental caries (30) and, over time, could benefit from the primary prevention offered by drinking fluoridated tap water. Accepting that tap water is safe is likely related to trust in local community water systems to monitor and protect public water from potentially dangerous chemicals and organisms. An analysis of 2010 HealthStyles data (22) found that 13 percent of respondents disagreed with the statement that their local tap water was safe to drink – the same percentage who responded that they disagreed with the statement that CWF was safe in this current analysis of 2009 HealthStyles data. Differences in agreement/disagreement that tap water is safe by race/ethnicity (22) also were quite similar to our findings.

We found that after controlling for CWF knowledge, compared with males, females were less likely to view CWF as safe. Mummery *et al.* (16) also reported that females were less likely to agree that CWF was safer. An analysis of Canadian survey data (15) found statistically significant differences by sex in CWF support after bivariate analysis but not in the multivariate model. Differences in perceived CWF safety between males and females could be explained, in part, by findings that females typically express higher levels of concern for potential environmental risks (31). A variety of factors, however, likely contribute to opinions about CWF, and thus, the presence of one factor alone would not be expected to directly translate into reduced support for CWF. The combined effect of multiple factors in shaping CWF opinions may help explain why 75 percent of females supported CWF compared with 65 percent of males in the American Dental Association's 1998 Consumers' Opinions Regarding Community Water Fluoridation Survey ($n = 1,003$, statistical significance was not assessed) (32).

This study presents several limitations. First, HealthStyles reaches a convenience sample and thus could be subject to bias. Second, because HealthStyles is a cross-sectional survey, causality cannot be assessed. Third, the survey neither assessed general awareness of CWF nor provided an option for “don't know” or “don't care” for CWF safety and benefits. Although CWF knowledge was controlled in the multivariate analyses, the proportion of respondents' answering CWF questions without any awareness of the topic remains unknown. Because survey respondents received incentives for participating, some may have felt obligated to answer questions, even though they were not aware of CWF. Fourth, the CWF benefit question asked respondents if CWF is beneficial to their “health,” requiring an understanding that oral health is related to overall health. A more direct question such as “do you believe that CWF is effective in the prevention of tooth decay?” (15) may have resulted in a different response distribution.

The primary strength of this study was its ability to examine the association between CWF perceptions and knowledge of CWF, controlling for potential confounders. Conducting multivariate analyses also allowed us to investigate the impact of other factors, beyond CWF knowledge, that could impact perceptions of CWF – and to assess the potential impact of those who answered in the middle of the Likert scales by running two multivariate models for each dependent variable (i.e., CWF safe/neutral and CWF not safe/neutral; CWF no benefit/some and CWF some/great benefit). Factors associated with perceived safety varied by whether the neutrals were combined with those who agreed or disagreed that CWF was safe. The inconsistency between the regressions could also be due, however, to our failure to control for interactions between the independent variables (e.g., income and education, CWF knowledge and education). Unfortunately, we did not have sufficient sample size to model all of the potential interactions.

To further an understanding of perceptions related to CWF, future studies could consider longitudinal measurements of a broader range of respondent variables. For instance, the following factors related to CWF could be assessed: ethical concerns, environmental concerns, intensity of support or opposition, and self-rated knowledge compared with actual knowledge of the purpose of CWF. Ideally, these measures would be evaluated before and after CWF educational and political campaigns to capture their impact on public perceptions.

In conclusion, this analysis found that both knowledge of CWF and perceptions regarding another public health intervention – safety of childhood vaccines – were strongly associated with perceptions of CWF safety and benefits. Future oral health promotion activities should consider differences in CWF perception among various groups to tailor educational messaging.

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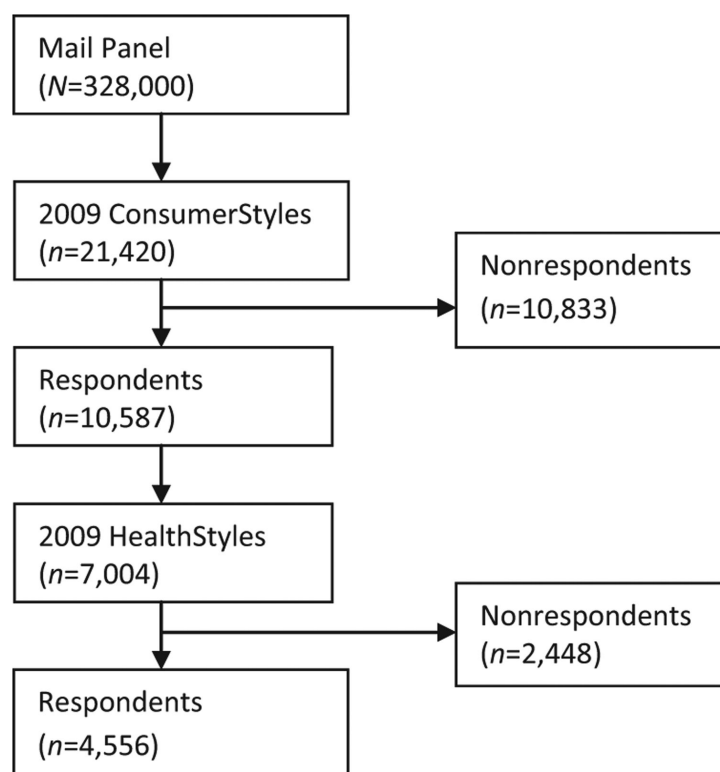


Figure 1.
Flowchart of sample for 2009 HealthStyles Survey.

Table 1

Description of Study Sample – Weighted and Nonweighted Frequencies

Variable	N (nonweighted)	HealthStyles nonweighted %, SE	HealthStyles weighted %, SE
Sex			
Male	2,227	48.88 (0.74)	48.50 (0.74)
Female	2,329	51.12 (0.74)	51.50 (0.74)
Age			
18-29	210	4.61 (0.31)	17.66 (0.56)
30-39	743	16.31 (0.55)	21.06 (0.60)
40-64	2,662	58.43 (0.73)	44.89 (0.44)
65+	941	20.65 (0.60)	16.40 (0.55)
Race/ethnicity			
Non-Hispanic White	2,950	64.75 (0.71)	68.86 (0.69)
Non-Hispanic Black	611	13.41 (0.50)	11.50 (0.47)
Hispanic	648	14.22 (0.52)	13.44 (0.50)
Other	347	7.62 (0.39)	6.20 (0.36)
Education			
Not HS graduate	293	6.49 (0.37)	5.73 (0.35)
HS graduate	1,137	25.18 (0.65)	24.38 (0.64)
Attended college	1,652	36.59 (0.72)	38.04 (0.72)
College graduate	1,433	31.74 (0.69)	31.85 (0.69)
Marital status			
Married/domestic partner	3,165	69.56 (0.68)	59.29 (0.73)
Widowed/divorced/separated	806	17.71 (0.57)	17.23 (0.56)
Never married	579	12.73 (0.49)	23.48 (0.63)
Children 18			
Yes	1,625	35.67 (0.71)	30.23 (0.68)
No	2,931	64.33 (0.71)	69.77 (0.68)
Household Income			
24,999	1,186	26.03 (0.65)	24.78 (0.64)
25,000-49,999	935	20.52 (0.60)	24.18 (0.63)
50,000-74,999	756	16.59 (0.55)	18.16 (0.57)
75,000-99,999	813	17.84 (0.57)	16.41 (0.55)
100,000	866	19.01 (0.58)	16.46 (0.55)
Region			
New England	778	17.08 (0.56)	17.91 (0.57)
Midwest	1,169	25.66 (0.65)	26.23 (0.65)
South	1,673	36.72 (0.71)	35.07 (0.71)
West	936	20.54 (0.60)	20.80 (0.60)
Dental knowledge – sealants			
Yes	2,253	51.02 (0.75)	48.81 (0.75)
No	2,163	48.98 (0.75)	51.19 (0.75)

Variable	N (nonweighted)	HealthStyles nonweighted %, SE	HealthStyles weighted %, SE
Dental knowledge – fluoridation			
Yes	2,110	49.65 (0.77)	47.91 (0.77)
No	2,140	50.35 (0.77)	52.09 (0.77)
Past year dental visit			
Yes	2,877	64.88 (0.72)	66.21 (0.71)
No	1,557	35.12 (0.72)	33.79 (0.71)
Safety of childhood vaccines			
Not at all safe (1, 2, 3)	152	3.38 (0.27)	3.99 (0.29)
Neutral (4, 5, 6, 7)	1,324	29.43 (0.68)	31.55 (0.69)
Very safe (8, 9, 10)	3,023	67.19 (0.70)	64.46 (0.71)

Weighted and Nonweighted Dependent Variable Categories and Response Frequencies (%)

Table 2

	N (%)									
	<u>Strongly disagree (not safe)</u>			<u>Neutral</u>			<u>Strongly agree (safe)</u>			
	1	2		3	4	5				
It is safe to drink from community water systems that add fluoride.	13.5 (nonweighted)			31.7 (nonweighted)		54.7 (nonweighted)				
	13.2 (weighted)			31.5 (weighted)		55.3 (weighted)				
	<u>No benefit</u>			<u>Some benefit</u>				<u>Great benefit</u>		
	1	2	3	4	5	6	7	8	9	10
How much benefit do you believe is likely to occur to a person's health if they routinely drink water that contains fluoride?				27.9 (nonweighted)		56.7 (nonweighted)			15.4 (nonweighted)	
				27.2 (weighted)		57.3 (weighted)			15.5 (weighted)	

Table 3Bivariate Analysis^{*} of Community Water Fluoridation Safety and Benefits

Variable	CWF safety				CWF benefits			
	Disagree	Neutral	Agree	P value	No benefit	Some benefit	Great benefit	P value
Sex				<0.001				0.038
Male	12.17	28.79	59.04		28.51	54.95	16.54	
Female	14.83	34.56	50.61		27.41	58.36	14.24	
Age				<0.001				0.015
18-29	23.08	33.17	43.75		28.50	57.97	13.53	
30-39	13.88	36.05	50.07		27.48	58.10	14.42	
40-64	13.61	31.44	54.95		26.65	56.64	16.71	
65+	10.88	28.84	60.28		31.99	55.37	12.64	
Race/ethnicity				<0.001				<0.003
Non-Hispanic White	11.07	30.08	58.85		26.41	58.36	15.23	
Non-Hispanic Black	16.13	38.66	45.21		29.97	57.36	12.67	
Hispanic	18.66	33.28	48.06		30.32	51.77	17.90	
Other	20.35	31.10	48.55		33.24	50.29	16.47	
Education				<0.001				<0.001
Not HS graduate	19.86	38.68	41.46		31.02	55.47	13.50	
HS graduate	15.30	37.39	47.32		34.10	54.96	10.94	
Attended college	14.49	34.77	50.73		27.52	58.37	14.10	
College graduate	9.86	22.25	67.89		23.21	56.49	20.30	
Marital status				<0.001				<0.001
Married/domestic partner	12.93	30.19	56.88		26.45	57.48	16.06	
Widowed/divorced/separated	13.62	34.80	51.58		31.85	56.79	11.36	
Never married	16.70	36.03	47.28		31.02	52.23	16.76	
Children 18				0.715				0.098
Yes	13.40	31.08	55.52		26.13	57.63	16.25	
No	13.60	32.11	54.28		28.98	56.16	14.86	
Household income				<0.001				<0.001
24,999	20.29	38.35	41.36		36.39	52.76	10.85	
25,000-49,999	14.13	32.58	53.29		28.35	56.37	15.27	
50,000-74,999	10.53	32.13	57.33		26.77	58.77	14.46	
75,000-99,999	11.28	29.12	59.60		23.25	59.13	17.63	
100,000	8.48	24.04	67.48		21.83	58.10	20.07	
Region				0.369				0.671
New England	12.44	31.35	56.22		26.80	57.65	15.56	
Midwest	12.76	31.81	55.43		26.53	57.21	16.27	
South	14.24	33.09	52.67		29.46	55.90	14.64	
West	14.15	29.59	56.26		27.99	56.64	15.37	
Dental knowledge – sealants				<0.001				<0.001
Yes	10.98	27.63	61.38		24.98	57.35	17.67	

Variable	CWF safety				CWF benefits			
	Disagree	Neutral	Agree	P value	No benefit	Some benefit	Great benefit	P value
No	15.99	36.44	47.56		31.23	55.50	13.26	
Dental knowledge – fluoridation				<0.001				<0.001
Yes	8.29	22.76	68.95		22.95	57.98	19.07	
No	18.79	40.99	40.23		33.72	56.04	10.24	
Past year dental visit				<0.001				0.001
Yes	11.46	28.71	59.83		25.91	56.68	17.41	
No	16.68	36.47	46.85		30.76	57.26	11.98	
Safety of childhood vaccines				<0.001				<0.001
Not at all safe (1, 2, 3)	44.67	29.33	26.00		65.54	31.76	2.70	
Neutral (4, 5, 6, 7)	17.42	39.80	42.78		28.16	63.38	8.46	
Very safe (8, 9, 10)	10.07	28.30	61.63		25.85	55.12	19.04	

* Analyses did not include sample weights.

Table 4Logistic Regression Models^{*} of Community Water Fluoridation Safety and Benefits

Variable	CWF safety				CWF benefits			
	Odds of responding that it is SAFE to drink from community water systems that add fluoride compared with not safe/neutral		Odds of responding that it is SAFE/ NEUTRAL to drink from community water systems that add fluoride compared with not safe		Odds of responding GREAT BENEFIT to person's health if they routinely drink water that contains fluoride compared with some benefit/no benefit		Odds of responding GREAT BENEFIT/ SOME BENEFIT to person's health if they routinely drink water that contains fluoride compared with no benefit	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Sex								
Male	1	Ref	1	Ref	1	Ref	1	Ref
Female	0.71	0.62-0.82	0.79	0.65-0.96	0.90	0.74-1.08	1.08	0.93-1.25
Age								
18-29	1	Ref	1	Ref	1	Ref	1	Ref
30-39	0.92	0.64-1.33	1.36	0.87-2.14	0.86	0.52-1.41	0.93	0.63-1.36
40-64	1.02	0.73-1.44	1.21	0.8-1.82	1.00	0.63-1.58	0.89	0.62-1.27
65+	1.35	0.93-1.97	1.62	1.01-2.61	0.80	0.48-1.33	0.69	0.47-1.02
Race/ethnicity								
Non-Hispanic White	1	Ref	1	Ref	1	Ref	1	Ref
Non-Hispanic Black	0.82	0.66-1.02	0.83	0.62-1.12	0.96	0.70-1.32	1.02	0.81-1.28
Hispanic	0.89	0.72-1.10	0.75	0.57-0.99	1.58	1.21-2.08	0.99	0.79-1.23
Other	0.69	0.53-0.91	0.56	0.40-0.78	1.12	0.79-1.60	0.76	0.58-1.00
Education								
Not HS graduate	1	Ref	1	Ref	1	Ref	1	Ref
HS graduate	1.10	0.80-1.52	1.15	0.78-1.70	0.83	0.52-1.34	0.87	0.62-1.21
Attended college	1.11	0.80-1.52	1.30	0.76-1.67	0.99	0.62-1.57	1.04	0.75-1.44
College graduate	1.69	1.21-2.37	1.23	0.81-1.88	1.20	0.74-1.93	1.11	0.78-1.56
Marital status								
Married/domestic partner	0.98	0.77-1.24	0.85	0.62-1.17	0.71	0.52-0.97	1.00	0.78-1.28
Widowed/divorced/separated	1.08	0.82-1.42	1.19	0.82-1.71	0.59	0.40-0.86	1.00	0.75-1.32
Never married	1	Ref	1	Ref	1	Ref	1	Ref
Children 18								
Yes	0.95	0.80-1.12	0.95	0.75-1.19	0.91	0.74-1.13	0.90	0.75-1.07
No	1	Ref	1	Ref	1	Ref	1	Ref
Household income								
<24,999	1	Ref	1	Ref	1	Ref	1	Ref
25,000-49,999	1.32	1.07-1.64	1.38	1.04-1.83	1.40	1.03-1.91	1.35	1.08-1.68
50,000-74,999	1.29	1.02-1.64	1.73	1.24-2.42	1.18	0.84-1.67	1.30	1.01-1.66
75,000-99,999	1.35	1.06-1.74	1.63	1.16-2.29	1.37	0.97-1.94	1.56	1.20-2.02
100,000	1.48	1.14-1.92	2.05	1.41-3.00	1.33	0.93-1.89	1.60	1.22-2.11
Region								
New England	1	Ref	1	Ref	1	Ref	1	Ref

Variable	CWF safety				CWF benefits			
	Odds of responding that it is SAFE to drink from community water systems that add fluoride compared with not safe/neutral		Odds of responding that it is SAFE/ NEUTRAL to drink from community water systems that add fluoride compared with not safe		Odds of responding GREAT BENEFIT to person's health if they routinely drink water that contains fluoride compared with some benefit/no benefit		Odds of responding GREAT BENEFIT/ SOME BENEFIT to person's health if they routinely drink water that contains fluoride compared with no benefit	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Midwest	1.08	0.87-1.34	1.07	0.78-1.46	1.13	0.86-1.49	1.00	0.80-1.26
South	1.04	0.85-1.27	1.00	0.75-1.33	1.00	0.77-1.31	0.92	0.75-1.14
West	1.04	0.83-1.31	0.92	0.67-1.27	0.84	0.62-1.14	0.89	0.70-1.13
Dental knowledge – sealants								
Yes	1.40	1.20-1.63	1.21	0.98-1.50	1.17	0.95-1.43	1.08	0.92-1.26
No	1	Ref	1	Ref	1	Ref	1	Ref
Dental knowledge – fluoridation								
Yes	2.60	2.26-3.00	1.99	1.61-2.45	1.84	1.51-2.25	1.51	1.30-1.76
No	1	Ref	1	Ref	1	Ref	1	Ref
Past year dental visit								
Yes	1.20	1.03-1.40	1.08	0.87-1.33	1.17	0.94-1.45	1.00	0.85-1.17
No	1	Ref	1	Ref	1	Ref	1	Ref
Safety of childhood vaccines								
Not at all safe (1, 2, 3)	1	Ref	1	Ref	1	Ref	1	Ref
Neutral (4, 5, 6, 7)	2.08	1.34-3.24	3.50	2.36-5.19	2.46	0.89-6.85	4.19	2.82-6.21
Very safe (8, 9, 10)	4.62	3.00-7.12	6.36	4.32-9.37	6.04	2.21-16.51	5.00	3.40-7.34
Hosmer-Lemeshow goodness of fit test <i>P</i> value	0.92		0.19		0.61		0.55	

* Regressions run without sample weights.